

We claim:

1. A purging system for clearing an accumulation of powder from a powder delivery tube comprising:

5 a sensor mounted outside the powder delivery tube between a powder source and a powder destination for producing signals representing a flow rate of powder within the powder delivery tube;

a source of fluid under pressure selectively connectable to a first location on said powder delivery tube through a first valve; and

10 a controller operatively connected to said sensor for controlling said first valve in response to the signals from said sensor.

2. The system of claim 1 including a normally open second valve connected between said powder source and said first location and operatively connected to said
15 controller.

3. The system of claim 2 including a normally open third valve connected between said powder destination and said first location and operatively connected to said controller.

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4. The system of claim 1 wherein said sensor comprises a temperature sensor.

5. The system of claim 3 wherein said controller closes said second valve and

opens said first valve for a first period of time when the signals from said sensor indicate said flow rate has dropped below a predetermined level.

6. The system of claim 3 wherein said controller closes said second valve and
5 opens said first valve for a first period of time when the signals from said sensor indicate said flow rate has dropped below a predetermined level, then closes said third valve and opens said second valve for a second period of time, then closes said first valve and opens said third valve.

10 7. A method of clearing an accumulation of coal in a coal tube connecting a source of coal to a tuyere comprising the steps of:
monitoring a condition on an exterior surface of the coal tube indicative of a flow rate of material through the coal tube;
determining when said flow rate has dropped to below a predetermined level;
15 stopping the flow of coal through said coal tube;
purging said coal tube with a fluid under pressure; and
restarting the flow of coal through said coal tube.

8. The method of claim 7 wherein the step of monitoring a condition on an
20 exterior surface of a coal tube comprises the step of monitoring the temperature of said coal tube.

9. The method of claim 8 wherein the step of determining when said flow rate

has dropped to below a predetermined level comprises the step of determining when the temperature of said coal tube has fallen below a predetermined level.

10. The method of claim 7 wherein the step of purging said coal tube comprises
5 the step of injecting a fluid into said coal tube at a point between said source and said tuyere.

11. The method of claim 10 wherein the step of stopping the flow of coal through
said coal tube comprises the step of closing a first valve between said coal source and
10 said point.

12. The method of claim 11 including the additional steps of closing a second
valve between said point and said tuyere and opening said first valve.

13. A method of clearing an accumulation of coal in a coal tube comprising the
15 steps of:

monitoring the temperature of a coal tube;

stopping the flow of coal through said coal tube when said temperature falls below
a predetermined level;

20 purging said coal tube with a fluid under pressure; and
restarting the flow of coal through said coal tube.

14. The method of claim 13 wherein the step of monitoring the temperature of a

coal tube comprises the step of monitoring the temperature of an exterior portion of a coal tube.

15. The method of claim 13 wherein the step of purging said coal tube comprises
5 the step of injecting a fluid into said coal tube at a point between said source and said tuyere.

16. The method of claim 15 wherein the step of stopping the flow of coal through
said coal tube comprises the step of closing a first valve between said coal source and
10 said point.

17. The method of claim 16 including the additional steps of closing a second
valve between said point and said tuyere and opening said first valve.

18. In a system comprising a blast furnace having at least one tuyere, a blowpipe
15 for delivering a heated fluid to said tuyere, a source of coal and a coal tube connected
between said source of coal and said blowpipe, the improvement comprising:

a source of pressurized fluid connected to said coal tube at a first location;
a first valve between said source of pressurized fluid and said coal tube for
20 controlling the flow of fluid from the source of pressurized fluid;
a second valve in said coal tube between said first location and said source of
coal;
a third valve in said coal tube between said first location and said tuyere;

a controller for controlling said first, second and third valves; and
a temperature measuring device operatively connected to said controller for
measuring the temperature of said coal tube.

5 19. The system of claim 18 wherein said temperature measuring device is
connected to the outside of said coal tube.

10 20. The system of claim 18 wherein said temperature measuring device
comprises a thermocouple.

15 21. The system of claim 18 wherein said controller closes said second valve and
opens said first valve for a period of time when the temperature of said coal tube falls
below a predetermined value and then closes said first valve and opens said second valve
after said period of time.

20 22. The system of claim 18 wherein said controller closes said second valve and
opens said first valve for a first period of time when the temperature of said coal tube
falls below a predetermined value, then closes said third valve and opens said second
valve for a second period of time, then closes said first valve and opens said third valve.

25 23. The system of claim 18 wherein said coal tube comprises a coal pipe
connected to said source of coal and a coal lance connected between said coal pipe and
said blowpipe.

24. The system of claim 23 wherein said temperature measuring device is operatively connected to said coal pipe.

5 25. The system of claim 24 wherein said temperature measuring device comprises a thermocouple.

26. A purging system for clearing an accumulation of coal from a coal lance fed by a coal pipe comprising:

10 a temperature sensor connected to the coal pipe for producing signals representative of a sensed temperature;

 a source of fluid selectively connectable to said coal lance through a valve; and

 a controller operatively connected to said sensor for controlling said valve in response to the signals from said sensor;

15 whereby said controller opens said valve for a period of time when the temperature of said coal pipe falls below a given level.

27. The system of claim 26 wherein said temperature sensor is connected to an exterior portion of said coal pipe.

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28. The system of claim 26 wherein said temperature sensor comprises a thermocouple.

29. A method of regulating the flow of coal in a system for delivering coal from a source of coal to a coal lance comprising the steps of:

connecting the source of coal to the coal lance with a coal pipe;

providing a source of fluid under pressure;

5 connecting the source of fluid to said coal pipe at a first location;

providing a first valve between the source of fluid and the first location;

providing a second valve between said source of coal and the first location;

providing a third valve between said first location and said coal lance;

closing said first valve and opening said second and third valves;

10 measuring the temperature of said coal pipe; and

if the temperature of said coal pipe falls below a given value, closing said second valve and opening said first valve for a first period of time.

30. The method of claim 29 including the additional step of closing said third
15 valve and opening said second valve for a second period of time.

31. The method of claim 29 including the additional step of closing said first
valve and opening said second valve.

20 32. The method of claim 30 including the additional step of closing said first
valve and opening said third valve.